DESCRIPTION OF THE COURSES

- Course code: ELR1361
- Course title: CIRCUITS THEORY IA
- Language of the lecturer: Polish

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	*2*	*1*			
*Number of hours/semester**	*20*	*10*			
Form of the course completion	*W r i t t e n testn*	*Colloquium*			
ECTS credits	*3*	*1*			
Total Student's Workload	*90*	*30*			

- Level of the course (basic/advanced): basic
- Prerequisites: Mathematical Analysis, Physics
- Name, first name and degree of the lecturer/supervisor: Lobos, Tadeusz, Prof., DSc, PhD.
- Names, first names and degrees of the team's members:
    1. Gubański, Adam, PhD
    2. Janik, Przemysław, PhD,
    3. Kostyła, Paweł, PhD,
    4. Leonowicz, Zbigniew, PhD,
    5. Motyl, Edmund, DSc, PhD,
    6. Piotrowicz, Jerzy, PhD,
    7. Pospieszna, Janina, DSc, PhD,
    8. Rezmer, Jacek, PhD,
    9. Ruczewski, Piotr, PhD,
    10. Sikorski , Tomasz, PhD.
    11. Wacławek Zbigniew, PhD
- Year:....I..... Semester:.....2.....
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course):

Knowledge of the analysis of linear one- and three-phase electric circuits, also with magnetic coupling.

- Form of the teaching (traditional/e-learning): traditional
- Course description:

The course contains items connected with analysis of. linear electric circuit with sinusoidal sources. Signal classification. The symbolic method. Voltages and currents on the RLC elements. Laws of the theory of circuits in the symbolic circuit analysis. Vector graphs. Thevenin's and Norton's theorem. equivalent circuits. The active, reactive and apparent power. Circuits with magnetic couplings.

- Lecture:
- Lecture:

Particular lectures contents	*Number of hours*
Basic notions. Kinds of electric charges. Charge interaction. The law of charge conservation.The notion of the electric field. Work of the displacement of the charge in the electric field. Voltage, potential, electric. current. Ohm's Law. Work and power. Dissipation of energy. 1. Capacitor, capacity. The relationship between current and voltage. Energy, the accumulation of energy. Coil. The relationship between current and magnetic flux. The inductance. Faraday's Law. Electromotive force. Active and passive elements. The source of voltage and current. Graphic symbols. Connections of the elements of electric circuits.. Linearity, stationarity and causality	2
Signals. 2. Aperiodic (step signal, impulse signal, exponential signal). Periodical (non-sinusoidal, sinusoidal signal). Average value, effective value. Coefficients of shape and peak. Measurement of the parameters of signals using measuring instruments.	2
3. Waveforms of voltages and currents on LCR elements. The response of elements LCR to typical signals (step signal, exponential signal, sinusoidal signal). Solving equations describing simple circuits with elements LR and CR. The transitory state. The steady state.	2
4. The symbolic method. The passage from temporal waveform to the complex form. The exponential signal. The complex function of the sinusoidal signal. The complex value. The algebraical and exponential form. The calculations with complex numbers. The geometrical interpretation of complex numbers. Ohm's Law and Kirchhoff statement in the complex form. Vector graphs. Phase shift and temporal delay. Impedance and admittance on the complex plane. Reactance and susceptance	2
5. Methods of solving the circuits. The general equation of the branch. Branch equations. The matrix of branch impedances. Ohm's Law and Kirchhoff's Law in the matrix form.	2
6. The method of loop currents and the node potentials. The notion of the loop current. Branch currents and loop currents (matrix form). The matrix of loop currents. The matrix of loop impedances. The generalized matrix of source voltages. Use of the method of loop currents. Branch voltages and node potentials (matrix form). The matrix node admittances. The generalized matrix of source currents. Use of the method of node potentials	2
7. The method of superposition. Equivalent systems. Conditions of application. Examples of the use of the method (bilateral power supply, sources with different pulsations). Notion of the equivalence of multi-terminal systems. The triangle-star transformation. Turning on additional sources. Moving the ideal sources of the voltage through the node. Moving ideal sources in the loop. Use of sources' moving to the exchange of equivalent active triangle-star connections.	2

8. Statements of Thevenin and Norton. Passive and active two-terminal networks. The voltage of the idle state. Impedance of substitute two-terminal network. Statement of Thevenin about the supplementary source of the voltage. The measurement of parameters of two-terminal network. Idle state and the condition of the short-circuit. The statement of Norton about the substitute current source. The exchange of sources.	2
9. The power in circuits with the sinusoidal current. Instantaneous and apparent power. The triangle of the power. The balance of the power. The coefficient of the power. The notion of active and passive component of voltage and current. The measurement of the power. Calculation of the passive and apparent power on the basis of the indications of instruments. The adjustment of receiver to the source. Efficiency of the source. The drop of the voltage and the loss of the power in the transmission line.	2
10. Circuits with magnetic couplings. The mutual inductance. The positive and negative coupling. De-coupling of the branch about the common node. Form of the matrix of loop impedances and matrix node admittances in circuits with couplings. Transfer of energy by the coupling. The transformer. The transmission .	2

- Classes – the contents:

Calculation of the average, effective value of simple non -sinusoidal signals. The passage from the temporal waveform to the complex function and inversely. The construction of vector graphs for LCR elements connected in series and parallel. Creating of the matrix of loop impedances. Calculation of currents using the method of loop currents. Creating the matrix node admittance. Calculation the node potentials of electric circuits. Utilization of the method of superposition for solving circuits. Utilization of the statements: Thevenin and Norton to the analysis of current flow.

- Laboratory – the contents:
- Project – the contents:
- Basic literature:

1. S. Osowski, K. Siwek, M. Śmiałek – ***Teoria Obwodów,*** Oficyna Wydawnicza Politechniki Warszawskiej, 2006.
2. S. Bolkowski - - ***Teoria Obwodów Elektrycznych*** -WNT 1995

- Additional literature:

1. M. Uruski, W. Wolski - ***Teoria Obwodów*** *t. I, II* - skrypt P.Wr.
2. K. Mikołajuk, Z. Trzaska - ***Elektrotechnika Teoretyczna*** - PWN 1984.
3. J. Osiowski, J. Szabatin - ***Podstawy Teorii Obwodów*** t. I, II, III - WNT 1992 - 1998

- Conditions of the course acceptance/credition: Passed examination, passed colloquium, reports and self-preparation work satisfactory evaluation.

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